

ATTACHMENT 1:
SPECIFICATIONS FOR AN L/S X-BAND ANTENNA SYSTEM

1.0 Synopsis

The Space Systems Development Department of the Naval Research Laboratory has a requirement for the design, fabrication, and inspection of a Titan Corporation/Datron Advanced Technologies Division, OR EQUAL, L/S X-band Antenna System. The primary components of the required system shall be (a) a 13-meter sectional solid aluminum reflector with torsion bracing, mounting struts and feed mounting assembly suitable for L/S and X-band operations; (b) an L/S Band autotrack feed assembly; and (c) a computer interface unit – feed controller assembly. The L/S Band autotrack antenna feed assembly shall be mounted in the 13-meter parabolic reflector. The required feed and reflector components shall be designed and fabricated to allow installation of an X-band autotrack feed assembly by Government personnel at some as yet undefined future date, and shall require little or no modification to the feed assembly or reflector to accomplish this task. Selection between feeds and the polarization of the S band feeds shall be remotely selectable through the computer interface unit that is also required as part of this specification. The antenna feed and reflector will be mounted on a pre-existing Datron Model 8450 electrically driven elevation-over-azimuth pedestal, and used as part of a satellite tracking system. As such, any proposed solution to this requirement shall be functionally and operationally compatible with the Government's existing equipment, which is described in greater detail in Section 2.2.10 of the specification. The L/S band antenna feed shall be mounted in a prime focus configuration and meet all of the requirements of the specification.

2.0. REQUIREMENTS

2.1 Construction

The reflector and autotrack feed assembly shall be designed and fabricated to allow disassembly, crating and transportation by commercial carrier. Its design shall facilitate its reassembly by NRL personnel after delivery, after which it shall comply with this specification. The reflector shall incorporate a central hub, solid surface panels, and torsion bracing. The feed and reflector shall also be designed to incorporate the addition of an X-Band feed in the future. The required X-band frequency range is 7.6 – 8.5 GHz.

2.2 Reflector

2.2.1 Diameter

The diameter of the reflector shall be thirteen meters.

2.2.2 Focal Length

The focal length shall be determined by the shape of the reflector, which shall be shaped for multi-band operations and optimized at the X-band frequencies.

2.2.3 Surface

The surface skin shall be solid-surface panels with a static surface tolerance not to exceed 0.030 inches RMS.

2.2.4 Weight

The weight shall not exceed 11,000 pounds.

2.2.5 Pointing Error

The peak (3σ) pointing error shall not exceed 0.01 degrees due to dead load and 0.031 degrees due to operating wind load.

2.2.6 Environmental

The reflector will be installed near Washington, D.C. and shall be designed to withstand the outdoor environment typical of that location.

2.2.6.1 Operating wind

The reflector shall comply with all specifications in a 55 mph wind.

2.2.6.2 Survival Wind

The reflector shall survive, without damage, a 110 mph wind with reflector stowed at zenith pointing position.

2.2.7 Natural Frequency

The natural frequency shall be equal to or greater than 10 cps in the axial mode and 7 cps in the torsional mode. A lower resonant frequency may be accepted if no servo instability results.

2.2.8 Finish

The reflecting surface shall be cleaned, primed and finished with two coats of Triangle Number 6 white paint or equivalent surfacing. The non-reflecting surfaces shall be cleaned, primed and coated with white paint.

2.2.9 Dynamics

The system shall operate at velocities of up to 12 degrees/second and accelerations of up to 12 degrees/second/second.

2.2.10 Mounting

The reflector will be mounted by NRL personnel on an existing (Datron model 8450) pedestal, and shall conform to the existing bolt hole pattern. Eight mounting holes, each one-inch diameter, are arranged, equally spaced, in a circular pattern. The diameter of the circle is 74 1/2 inches, measured from center-to-center of the bolt holes.

2.3.0 Computer Interface Unit

The required system shall include a computer interface unit to (a) control the selection of the S band right or left hand polarization, (b) control the selection of L, S, or X band feeds, and (c) provide return status indicating the operational state of the unit. The electrical interface to this unit shall be RS-422. In addition, inclusion of an IEEE-488 test interface capable of selecting feeds, polarization and any other instrumentation necessary to maintain the unit is desirable.

2.4.0 S-Band Feed

The S-band feed will be mounted in a prime focus configuration and will be required to illuminate the 13 meter reflector. The feed shall receive and transmit right-hand circular and left-hand circular polarizations (mounted in the reflector) and shall generate autotrack error signals which shall be coupled into the tracking channel to produce a single-channel monopulse (SCM) signal. Tracking channel losses in front of the pre-amplifier shall be kept to an absolute minimum. It is required that The antenna S band feed shall be capable of maintaining autotrack within ± 0.2 degree during normal operation. The method used to generate the error signals will be at the Contractor's option

2.4.1 S Band Electrical Requirements

2.4.1.1 Frequency

The S-band feed shall operate over the frequency range from:

Receive	2.2 GHz to 2.4 GHz
Transmit	1.75 GHz to 1.85 GHz
	2.025 GHz to 2.120 GHz

2.4.1.2 S Band Polarization

Selectable between Right-hand circular or Left-hand circular (mounted in reflector).

2.4.1.3 Power Handling

Minimum power handling capacity - 300 watts peak

2.4.1.4 VSWR

The VSWR shall be 1.5:1 maximum for both data and tracking channels.

2.4.1.5 Isolation

Isolation between the receive and transmit ports shall be 95 dB or greater.

2.4.1.6 Preamplifier

Preamplifiers shall be provided as part of the feed assembly. The amplifiers used for the Data and Tracking channels shall have a gain of 50 dB with a maximum noise temperature of 45 Kelvin.

2.4.1.7 Test Port

The contractor shall provide a means of testing the feed performance by the use of a test port. Through this test port a means of testing both right-hand circular and left-hand circular polarities shall be provided. A noise diode shall be incorporated for testing the y- factor of the preamplifiers.

2.5 DRAWINGS AND DATA

All interfaces shall be defined in vendor-supplied drawings. The reflector shall be assembled, matched marked, pinned, and contour measured at the vendor facility prior to shipment. Surface measurement data shall be provided.

2.6 QUALITY ASSURANCE

Inspection shall be performed to ensure compliance with the best commercial practices and with this specification.

2.7 SHIPMENT

The reflector shall be prepared for commercial shipment, and delivered to the address indicated.